

REMARKS

Claims 1-7 remain pending after amendment.

Drawing Correction

The Examiner requires new drawings to be submitted. Applicants note that the originally-filed drawings are photomicrographs. Hence, the detail of the drawings will not be as clear as a normal drawing. However, applicants will endeavor to provide substitute drawings to the extent drawings are available that are of greater detail.

Rejection of Claims 1-5 and 7 under 35 USC 102(e)

Claims 1-5 and 7 stand rejected under 35 USC 102(e) as being anticipated by Hirai et al U.S. Patent No. 6,664,313.

In support of the rejection, the Examiner states as follows:

“Hirai et al. disclose all ingredients claimed by applicants and the concentrations disclosed encompass applicants’ claimed amounts. A reference is not limited to its illustrative examples.”

The rejection of the Examiner is respectfully traversed.

As described at page 8, line 4 to page 9, line 14 of the present specification, the object of the present invention is to provide a flame retardant aromatic polycarbonate resin composition which exhibits excellent flame retardancy without using a conventional bromine-containing or phosphorus-containing flame retardant (which adversely affects the properties of the resin composition due to the unsatisfactory thermal stability thereof, and is harmful to the environment). In addition, the composition exhibits excellent melt stability without sacrificing the excellent thermal resistance and impact resistance which an aromatic polycarbonate inherently possesses.

Conventionally, various attempts have been made to improve the above-mentioned properties of the flame retardant aromatic polycarbonate resin composition. However, the conventional techniques suffer from a technical dilemma that, when some of the above-mentioned properties are

improved, other properties are sacrificed, so that it has been difficult to simultaneously improve all of the above-mentioned properties (see page 2, line 6 to page 7, line 24 of the present specification).

The present inventors have made extensive studies and found that the above-mentioned object of the present invention can be achieved by a flame retardant aromatic polycarbonate resin composition as claimed – that is, a flame retardant aromatic polycarbonate resin composition comprising:

100 parts by weight of an aromatic polycarbonate (A),

0.01 to 0.5 part by weight of **branched** metal oxide particles (B), each independently being a branched metal oxide aggregate or a branched metal oxide agglomerate,

0.0001 to 0.2 part by weight of an alkali metal salt (C) of an organic sulfonic acid, and

0.01 to 0.5 part by weight of a fluoropolymer (D),

the branched metal oxide particles (B) being dispersed in a mixture of the aromatic polycarbonate (A), the alkali metal salt (C) and the fluoropolymer (D),

wherein **at least 70 %** of the branched metal oxide particles (B) have a diameter within the range of from **10 to 200 nm**.

The effects achieved by such a flame retardant aromatic polycarbonate resin composition of the present invention are clearly confirmed in the Examples and Comparative Examples of the present application. That is, the Examples and Comparative Examples of the present application clearly show that the flame retardant aromatic polycarbonate resin composition of the present invention which contains components (A) to (D) in the recited amounts enables the following advantages to be achieved:

(1) excellent flame retardancy without using a conventional bromine-containing or phosphorus-containing flame retardant (which adversely affects the properties of the resin composition due to the unsatisfactory thermal stability thereof, and is harmful to the environment); and

(2) excellent melt stability without sacrificing the excellent thermal resistance and impact

resistance which an aromatic polycarbonate inherently possesses.

The cited reference fails to teach or suggest that the combined use of the specific components defined in claim 1 of the present application in the recited amounts is effective for solving the above-mentioned technical dilemma (where some of the above-mentioned properties are improved and other properties sacrificed) and for obtaining a flame retardant aromatic polycarbonate resin composition which simultaneously exhibits the above-mentioned advantages (1) and (2).

With respect to Hirai et al, while this reference generally discloses components corresponding to those recited in claim 1, Hirai et al fails to teach or suggest the combined use of the components defined in claim 1 in the amounts recited therein, together with the advantages achieved thereby. In fact, none of the compositions obtained in the Examples of Hirai et al meet the requirements of the present invention. The reference thus cannot be said to anticipate the claimed invention.

Further, applicants have conducted investigations with respect to the silicone powder products mentioned in Hirai et al, and, as a result, have determined as discussed below that the resin composition of Hirai et al does not satisfy the above-mentioned requirements concerning the component (B) of the present invention.

With respect to “titanium oxide (b)” recited in claim 1 of Hirai et al, Hirai et al teaches that “titanium oxide (b)” usually has a particle diameter of “0.1 to 0.7 μm ” (col. 3, lines 30 to 31) which overlaps with the range (10 to 200 nm) recited in claim 1 of the present application. However, Hirai et al is silent as to whether the “titanium oxide (b)” has a branched structure. Further, even if “titanium oxide (b)” has a branched structure, this component is used in an amount of “3 to 30 parts by weight” (claim 1) which is much greater than the upper limit (0.5 part by weight) recited in claim 1 of the present application.

With respect to “silicone powder (c)” recited in claim 1 of Hirai et al, Hirai et al is silent regarding the particle diameter of “silicone powder (c)” recited in claim 1 thereof, which comprises “0.01 to 9 parts by weight of silica (c1) and 0.01 to 9 parts by weight of a polyorganosiloxane polymer (c2) carried on the silica (c1)”. Specific examples of such “silicone powder (c)” are mentioned

in the examples of Hirai et al. The silicone powder products mentioned in the examples of Hirai et al are as follows (see col. 11, lines 32 to 43 of Hirai et al):

“(3) Silicone powder 1: 60 wt % of linear polydimethylsiloxane having a viscosity of 60,000 cSt was carried on 40 wt % of silica and powdered (trade name Trefil F202, produced by Toray Dow Corning Silicone Co., Ltd.)”

“(4) Silicone powder 2: 60 wt % of polydimethylsiloxane having a methacrylic group was carried on 40 wt % of silica and powdered (trade name DC 4-7081 produced by Dow Corning Co., Ltd.).”

“(5) Silicone powder 3: 60 wt % of polydimethylsiloxane having an epoxy group was carried on 40 wt % of silica and powdered (trade name DC 4-7051, produced by Dow Corning Co., Ltd.)”

With respect to such silicone powder products, applicants have conducted an investigation and determined that each of the silicone powder products used in Hirai et al has a particles diameter of at least 1 μ m. On the other hand, in the present invention, it is necessary that at least 70 % of the branched metal oxide particles (B) have a diameter within the range of from 10 to 200 nm, which is less than that taught by the reference as described below.

Silicone powder 1 (“Trefil F202” produced by Toray Dow Corning Silicone Co., Ltd)

Applicants submit herewith, as “Exhibit 1”, a copy of a silicone polymer product catalogue of Toray Dow Corning Silicone Co., Ltd., and a verified partial English translation thereof.

Exhibit 1 clearly shows that “Trefil F202” has a particle diameter of from 10 to 300 μ m. See (3) above.

Silicone powder 2 (“DC 4-7081” produced by Dow Corning Co., Ltd.) and Silicone powder 3 (“DC 4-7051” produced by Dow Corning Co., Ltd.)

Applicants submit herewith (1) a copy of Dow Corning’s product information on “Si Powder

Resin Modifiers” (Exhibit 2), (2) copies of US Patent Nos. 5,412,014 (Exhibit 3) and 5,391,594 (Exhibit 4), which are mentioned in Exhibit 2, and (3) a copy of US Patent No. 5,610,223 (Exhibit 5).

In Exhibit 2 (Dow Corning’s product information), both of “DC 4-7081” and “DC 4-7051” are mentioned as “Si Resin Modifier” (see Table appearing on the first sheet of Exhibit 2). Further, Exhibit 2 states that Dow Corning’s Si Resin Modifiers are used in US Patent Nos. 5,412,014 (Exhibit 3) and 5,391,594 (Exhibit 4) (see second sheet, middle column, 3rd paragraph of Exhibit 2).

In both of US Patent Nos. 5,412,014 (Exhibit 3) and 5,391,594 (Exhibit 4), it is described that the silicone polymer powder used therein has “an average particle size of 1 to 1000 microns” (see Abstracts of Exhibits 3 and 4). See (4) and (5) above.

Further, in US Patent No. 5,610,223 (Exhibit 5), both of “RM 4-7081” and “RM 4-7051” (wherein “RM” apparently means “Resin Modifier”) are mentioned as “silicone rubber powder” (see col. 3, lines 23 to 25), and it is described that the “silicone rubber powder” has an “average particle size of 1 to 1000 microns” (see claim 1) which is completely in agreement with the descriptions of Exhibits 3 and 4).

Thus, it is apparent that the “silicone powder (C)” used in Hirai et al has an average particle diameter of at least 1 μm , far greater than claimed by applicants.

Therefore, Hirai et al do not teach the above-mentioned requirements regarding the branched metal oxide particles (B) used in the present invention for the following reasons:

(1) even if the titanium oxide (b) used in Hirai et al has a branched structure and a particle diameter within the range (10 to 200 nm) recited in claim 1 of the present application, the amount (3 to 30 parts by weight) of the titanium oxide (b) employed is too large (0.01 to 0.5 part by weight in the present invention), and, hence, the resin composition of Hirai et al falls outside the scope of claim 1 of the present application, irrespective of whether or not the silicone powder (c) has a branched structure, and

(2) if only the silicone powder (c) has a branched structure and the titanium oxide (b) does not have a branched structure, the particle diameter (at least 1 μm) of the silicone powder (c) is too large

(in the present invention, at least 70 % of the branched metal oxide particles (B) has a diameter within the range of from 10 to 200 nm), and, hence, the resin composition of Hirai et al falls outside the scope of claim 1 of the present application.

Thus, it is apparent that claim 1 of the present application is not anticipated by Hirai et al.

Further, the advantages achieved by satisfying the above-mentioned requirements regarding the branched metal oxide particles (B) are clearly substantiated in the Examples and Comparative Examples of the present application. In this connection, attention is drawn to Tables 1, 2 and 3 which are, respectively, shown at pages 73, 78 and 82 of the specification of the present application.

Specifically, in all of the Examples of the present application, the obtained resin compositions not only exhibit excellent flame retardancy without using a bromine-containing flame retardant or a phosphorus-containing flame retardant, but also exhibit excellent melt stability without sacrificing the excellent thermal resistance and impact resistance which an aromatic polycarbonate inherently possesses.

On the other hand, in Comparative Examples 1 to 5 and 7 to 11 (in which at least one of the requirements about the branched metal oxide particles (B) is not satisfied), at least one of the above-mentioned properties (i.e., flame retardancy, melt stability, thermal resistance and impact resistance) becomes poor.

Since none of the cited references has any teaching or suggestion about the importance of the above-mentioned requirements about the branched metal oxide particles (B) used in the present invention, it is also apparent that the present invention is neither anticipated by nor obvious over the prior art.

The rejection is thus without basis and should be withdrawn.

Rejection of Claims 1-7 under 35 USC 103(a)

Claims 1-7 stand rejected under 35 USC 103(a) as being unpatentable over Hirai et al '313 or Rajagopalan et al '357, in view of Hoover '011 or Allen et al '677.

In support of the rejection, the Examiner states as follows:

“Hirai et al. has been discussed already. Additionally Hirai et al. disclose glass fibers in column 10, line 13, without specifying the amount to be used. Rajagopalan et al. teach polycarbonate, PTFE, fumed silica and KSS in Table 2. The KSS concentration is outside the limits of applicants’ claims, however the patent also teaches 0.1 % potassium perfluorobutyl sulfonate which can be substituted for KSS. Picking and choosing is permitted in obviousness rejections. See In re Arkley 172 USPQ 526 (CCPA 1972). The reference also teaches 1-100 parts of glass fibers in column 7, lines 20-40. The secondary references are used only to show that using glass fibers, as fillers, in concentration claimed in claim 6, would have been obvious to one having ordinary skill in the art; at the time the invention was made. Applicants are arguing against an anticipation rejection, when the instant rejection is for obviousness.”

This rejection is respectfully traversed.

As already mentioned above, Hirai et al fails to teach or suggest the essential features of the present invention and the above-mentioned excellent advantages achieved thereby.

Further, with respect to Rajagopalan et al, this reference discloses the use of a fumed silica in Table 2. However, it is apparent that, in the composition of Rajagopalan et al, a major part of the fumed silica is reacted with or incorporated into silsesquioxane which is an essential component of the composition of Rajagopalan et al. On the other hand, in claim 1 of the present application, it is required that “branched metal oxide particles (B) being dispersed in a mixture of said aromatic polycarbonate (A), said alkali metal salt (C) and said fluoropolymer (D)”. The present invention does not exclude the use of silsesquioxane. However, the composition of Rajagopalan et al is different from the composition of the present invention in that the fumed silica is not dispersed in the mixture of an aromatic polycarbonate, an alkali metal salt and a fluoropolymer, but is biasedly present in the silsesquioxane phase. More specific explanation is made below.

Rajagopalan et al states as follows:

“In addition, molded parts from a formulation containing polycarbonate combined with 5 weight % poly(phenyl vinyl silsesquioxane), a low loading of anti-

drip agent poly(tetrafluoroethylene) (0.1 weight %), a synergist such as potassium diphenylsulfone-3-sulfonate (0.3 weight %) and amorphous fumed silica (0.3 weight %) showed improvement in light transmission. Percent transmission was 63.3% at 1/16 inch thickness.” (emphasis added) (col.9, lines 56-64)

Further, Table 5 at columns 13-14 of Rajagopalan et al describes that a composition (Blend No. 5) containing a fumed silica (“Amorphous fumed silica (with a surface area of 140 square meters per gram) was obtained from DeGussa” (col.10, lines 31-33 of Rajagopalan et al)) has an improved light transmittance, while other compositions are opaque.

In this connection, it should be noted that the fumed silica has a reactivity with organic silicon compounds (such as silsesquioxane) and has a refractive index of 1.46 which is close to the refractive indexes of many synthetic resins. In this connection, attention is drawn to the following descriptions of “TECHNICAL BULLETIN AEROSIL®” (issued by Nippon Aerosil Co., Ltd. which is a joint venture between Mitsubishi Materials Corporation and Degussa Japan Co., Ltd.), a copy of which is submitted herewith together with a partial English translation thereof as “Exhibit 6”:

“The silanol groups present in the surface of an AEROSIL particle are bonded to H₂O molecules. This means that AEROSIL is generally hydrophilic. The silanol groups present in the surface of an AEROSIL particle are reactive with organosilicon compounds (e.g., dimethyl chlorosilane).” (emphasis added) (page 2, item (3) of the particle English translation),

“Another characteristic feature of AEROSIL is that the refractive index thereof is 1.46 which is close to the refractive indexes of many synthetic resins.” (emphasis added) (page 2, item (4) of the partial English translation), and

“AEROSIL can be blended in a large amount with a heat-vulcanized silicone rubber and/or various other elastomers, so as to impart desired mechanical, electric and optical properties to the rubber and/or elastomers.” (emphasis added) (page 3, item (5) of the partial English translation).

Thus, in the above-mentioned Blend 5 of Rajagopalan et al, the fumed silica is reacted with or incorporated into the silsesquioxane so as to bring the refractive index of the silsesquioxane into con-

formity with the refractive index of the polycarbonate, thereby improving the light transmittance of the polycarbonate resin composition. Accordingly, in Blend 5 of Rajagopalan et al, a major part of the fumed silica is not dispersed in the mixture of an aromatic polycarbonate, an alkali metal salt and a fluoropolymer, but is reacted with or incorporated into the silsesquioxane and, hence, is biasedly present in the silsesquioxane phase. Further, even if a reaction product of the fumed silica with the silsesquioxane is considered as the component (B) used in the present invention, Rajagopalan et al is silent regarding the morphologies and particle diameters of such a reaction product.

On the other hand, in the composition of the present invention, it is required that the branched metal oxide particles (B) be dispersed in the mixture of the aromatic polycarbonate (A), the alkali metal salt (C) and the fluoropolymer (D), wherein at least 70 % by weight of the branched metal oxide particles (B) have a diameter within the range of from 10 to 200 nm.

From the above, it is apparent that Rajagopalan et al also has no teaching or suggestion about the above-mentioned requirements about the component (B) used in the present invention. As already mentioned above, in the present invention, the requirements about the component (B) are essential for achieving excellent flame retardancy without using a bromine-containing flame retardant or a phosphorus-containing flame retardant, and excellent melt stability without sacrificing the excellent thermal resistance and impact resistance, which an aromatic polycarbonate inherently possesses.

In addition, it should be noted that the desired advantages of the present invention can be achieved only when the specific components (A), (B) and (C) are used in a specific weight ratio. On the other hand, none of the compositions (such as Blends 1 to 6 shown in Table 2) disclosed in Rajagopalan et al has the specific combinations of components used in the specific weight ratio.

Therefore, it is apparent that the present invention is not anticipated by, or obvious over, Rajagopalan et al.

With respect to the cited secondary references, the Examiner relies on these references “only to show that using glass fibers, as fillers, in the concentration claimed in claim 6, would have been obvious to one having ordinary skilled in the art; at the time the invention was made”. As

mentioned above, claim 1 is not anticipated by obvious over Hirai et al and Rajagopalan et al, and, hence, the claims dependent from claim 1 is also not anticipated by, or obvious over, the prior art references.

The cited references, taken either singly or in combination, thus do not render obvious the claimed invention.

The rejection is without basis and should be withdrawn.

Double Patenting Rejection

Claims 1-7 stand provisionally rejected on the ground of obviousness-type double patenting over claims 1-13 of application No. 10/507,903, as well as over claims 1-8 of application No. 10/504,297.

As these are provisional rejections, no action is required at this time by applicants. However, applicants will endeavor to maintain a line of distinction between the respective sets of claims.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Raymond C. Stewart (Reg. No. 21,066) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

Dated: May 1, 2006

Respectfully submitted,

By 

Raymond C. Stewart

Registration No.: 21,066

RCS/JWH/sh

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Attachments: Exhibits 1-6

Exhibit 1

DECLARATION OF TRANSLATOR

I, Maho KASEKI, c/o the Inoue & Associates of 3rd Floor, Akasaka Habitation Building, 3-5, Akasaka 1-chome, Minato-ku, Tokyo, Japan do solemnly and sincerely declare that I am conversant with the Japanese and English languages and that I have executed with the best of my ability this partial translation into English of a product catalogue issued by Toray Dow Corning Silicone Co., Ltd. annexed hereto, and believe that the translation is true and correct.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements jeopardize the validity of the application or any patent issued thereon.

April 28, 2006
(Date)

Maho KASEKI
Maho KASEKI

Partial English Translation of the product catalogue issued
by Toray Dow Corning Silicone Co., Ltd.

(1) Front Cover, the top line:

Toray Dow Corning Silicone Co., Ltd. Product Catalogue

(2) Page 65, upper half portion:

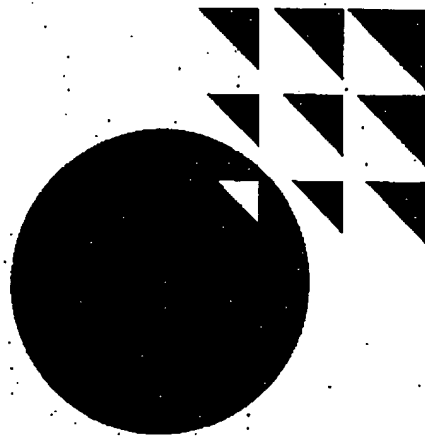
Silicone Powder

Application field	Trade name	Form	Particle size distribution (μm)	Silicone content (%)	True specific gravity at 25°C
Additives for a rubber or a plastic; Water repellent used in a building material; Anti-blocking agent for a film; Additives for abrasives	Trefil F-201	Indefinite	10 - 300	60	1.5
	Trefil F-202	Indefinite	10 - 300	60	1.5
	Trefil F-250	Indefinite	10 - 300	60	1.4
	Trefil F-300	Indefinite	10 - 500	60	1.5

(3) Back cover:

Toray Dow Corning Silicone Co., Ltd.

Issued in May 1998 Y50213980550KA(F8912)



TORAY
DOW CORNING
SILICONE

Open Up The Future

It's
Silicone

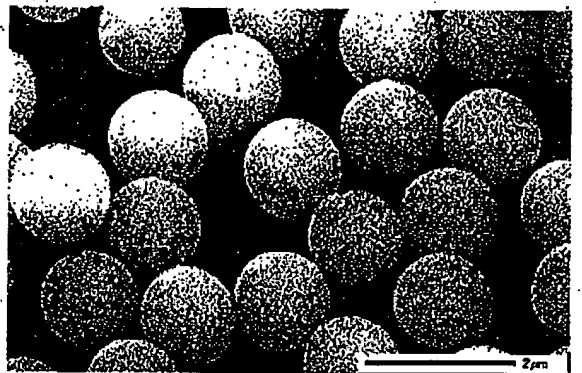
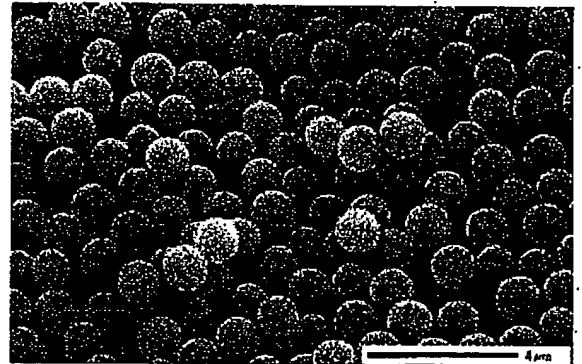
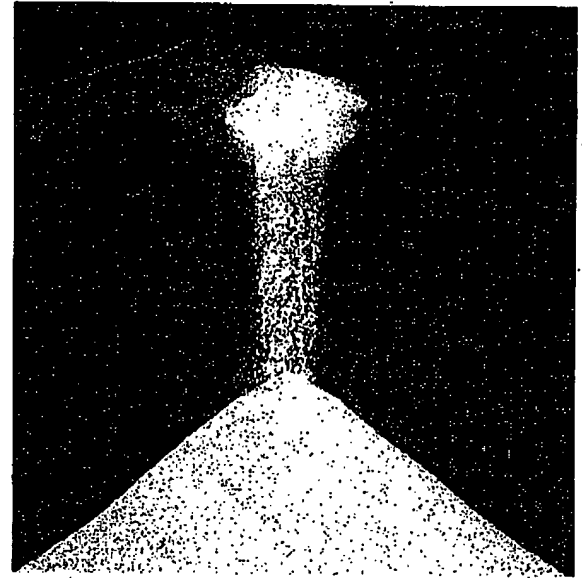
シリコーンパウダー

用 途	製品名	形 状	粒形分布 (μ m)	シリコーン分 (%)	真比重 (25℃)
ゴム、プラスチック添加剤 塗材の不透水性剤 ワイヤのブローキング防止剤 ポリウレタン製品の添加剤	トレフィルF-201	不 定 形	10~300	60	1.5
	トレフィルF-202	不 定 形	10~300	60	1.5
	トレフィルF-250	不 定 形	10~300	60	1.4
	トレフィルF-300	不 定 形	10~500	60	1.5
粉末の流動化剤 塗料用フイラー 無機素材の吸水付与剤	トレフィルR-900	不 定 形	3~80	100	1.3
	トレフィルR-902A	不 定 形	3~30	100	1.3
	トレフィルR-910	微小 フレーク状	—	100	1.2
	トレフィルE-500	球 状	1~15	100	0.97
ゴム、プラスチック改質剤 オイルなどの担持材	トレフィルE-600	球 状	1~10	100	0.98
	トレフィルE-601	球 状	1~10	100	0.98
	トレフィルE-850	不 定 形	10~250	100	0.98

【シリコンパウダー】は、「耐熱性」「耐候性」「撥水性」「潤滑性」などのシリコンの特長をもつとともに、パウダー状のため、「流動性」「分散性」「計量性」「作業性」にも優れています。

★製品には、シリコンオイルを高濃度に無機担持材に担持させたもの(Fタイプ)、シリコンレジンのパウダー化したもの(Rタイプ)、さらに、シリコンエラストマーを超微粒子化したもの(Eタイプ)の3種類に大別されます。

比重 (25℃)	水分 (%)	備考
0.4	<0.5	シメチルシリコンオイル 30,000cs
0.4	<0.5	シメチルシリコンオイル 60,000cs
0.4	<5.0	シメチルシリコンオイル 12,500cs
0.5	<0.5	フェニルシリコン シリコンオイル
0.30	<1.0	標準タイプ
0.30	<1.0	シリコンレジン パウダー
—	<1.0	溶剤可溶タイプ
0.14	<0.5	撥水性タイプ
0.20	<0.5	メチルシリコン シリコンゴム パウダー
0.19	<0.5	エポキシ系高相 容シリコン
0.31	<0.2	メチルシリコン



上/シリコンパウダーサンプル
中・下/電子顕微鏡による拡大写真

東レ・ダウコーニング・シリコン株式会社

Product Information

Plastics

DOW CORNING

DOW CORNING® Si Powder Resin Modifiers

FEATURES

- Improved properties of plastics, including reduced heat release rate, smoke and smoke evolution, increased impact strength and easier processing

BENEFITS

- Improved ease in processing thermoplastics
- Reduces the rate of heat release or smoke or carbon monoxide evolution
- Improves the mechanical properties of highly filled resin systems

COMPOSITION

- Free-flowing powder

Powdered siloxane

APPLICATION

- Plastic additives

TYPICAL PROPERTIES

Specification writers: These values are not intended for use in preparing specifications. Please contact your local Dow Corning sales representative prior to writing specifications on this product.

Property	Unit	Value
Form		Powder
Color		White to off-white
Product		Organic reactivity
DOW CORNING® 4-7105 Resin Modifier		None
DOW CORNING® 4-7051 Resin Modifier		Epoxy
DOW CORNING® 4-7081 Resin Modifier		Methacrylate

INTRODUCTION

DOW CORNING Si Powder Resin Modifiers are a family of powdered siloxane plastic additives that are designed to impart processing or physical property improvements to formulated plastic systems. A series of siloxane powders has been designed with varying compatibilities in a variety of thermoplastic polymers.

DOW CORNING Si Powder Resin Modifiers are recommended as additives in highly filled flame retardant plastic formulations. Benefits observed include reduced heat release rate, smoke and rate of toxic gas evolution, increased impact strength, and easier processing.

DESCRIPTION

DOW CORNING Si Powder Resin Modifiers are 100% active, free-flowing, siloxane powders. They are available in several grades with varying types of organic reactivity

(none, epoxy and methacrylate). The organic reactivity controls the compatibility, and often, the performance of DOW CORNING Si Powder Resin Modifiers in selected plastic applications.

BENEFITS

At levels of 0.1% to 1.0%, DOW CORNING Si Powder Resin Modifiers can improve the ease of processing thermoplastics, giving reduced extruder torque, reduced power consumption and improved surface gloss. Levels of 1% to 8% DOW CORNING Si Powder Resin Modifiers can modify the burning characteristics of thermoplastics, reducing the rate of heat release and the rate of smoke and carbon monoxide evolution. Similar burning characteristic modifications have been observed in halogen-free, halogenated and phosphorus flame retardant systems.

In highly filled halogen-free FR

thermoplastics DOW CORNING Si Powder Resin Modifiers can act as a process aid to improve the ease of processing. Additional processing benefits may result via a necessary reduction in levels of solid FR additive in the formulation. DOW CORNING Si Powder Resin Modifiers can help improve mechanical properties of highly filled resin systems. Levels of 3% to 5% can help restore impact strength that is lost when FR fillers are added; levels of 15% in unfilled engineering thermoplastics can give an improvement in impact strength. See Tables 2 and 3, and Figures 1 and 2 for comparative performance data. A technical paper, "The Role of Silicone Powders in Reducing the Heat Release Rate and Evolution of Smoke in Flame Retardant Thermoplastics," which gives a detailed discussion of benefits of siloxane powders, is available from Dow Corning.

LIMITATIONS

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

HOW TO USE

DOW CORNING Si Powder Resin Modifiers and thermoplastic pellets are pre-mixed at a ratio to give the desired siloxane level in the final product. If powdered flame retardant (FR) additives are in the compound, it is often desirable to mix the siloxane powder with the powdered FR additives. Processing is handled the same as is normally done for the thermoplastic alone. Often easier processing, lower extruder pressure and faster throughput are observed.

HANDLING PRECAUTIONS

PRODUCT SAFETY
INFORMATION REQUIRED FOR
SAFE USE IS NOT INCLUDED.
BEFORE HANDLING, READ
PRODUCT AND SAFETY DATA
SHEETS AND CONTAINER
LABELS FOR SAFE USE,
PHYSICAL AND HEALTH
HAZARD INFORMATION. THE
SAFETY DATA SHEET IS
AVAILABLE FROM YOUR LOCAL
DOW CORNING SALES
REPRESENTATIVE.

USABLE LIFE AND STORAGE

When stored at or below 60°C (140°F) in the original unopened containers DOW CORNING Si Powder Masterbatch has a usable life of 24 months from the date of production.

PACKAGING

This product is available in a variety of container sizes. Contact your local Dow Corning sales representative for information about container sizes available in your area.

PATENT POSITION

A composition prepared by mixing DOW CORNING Si Powder Resin Modifiers and an organic resin is claimed in U.S. Patents 5,391,594 and 5,412,014. Dow Corning intends to enforce these patents, but will offer licenses thereunder. If a license is needed, Dow Corning will ship the product in containers that bear a label license and the invoice will reflect the royalties charged. Alternatively, upon written request, Dow Corning will offer a license agreement at a comparable royalty rate under which the licensee may handle its own accounting of royalties due, regardless of the source of the material.

HEALTH AND ENVIRONMENTAL INFORMATION

To support customers in their product safety needs, Dow Corning has an extensive Product Stewardship organization and a team of Health, Environment and Regulatory Affairs specialists available in each area.

For further information, please consult your local Dow Corning representative.

WARRANTY INFORMATION - PLEASE READ CAREFULLY

The information contained herein is offered in good faith and is believed to be accurate. However, because conditions and methods of use of our products are beyond our control, this information should not be used in

substitution for customer's tests to ensure that Dow Corning's products are safe, effective, and fully satisfactory for the intended end use. Dow Corning's sole warranty is that the product will meet the Dow Corning sales specifications in effect at the time of shipment. Your exclusive remedy for breach of such warranty is limited to refund of purchase price or replacement of any product shown to be other than as warranted. Dow Corning specifically disclaims any other express or implied warranty of fitness for a particular purpose or merchantability. Unless Dow Corning provides you with a specific, duly signed endorsement of fitness for use, Dow Corning disclaims liability for any incidental or consequential damages. Suggestions of use shall not be taken as inducements to infringe any patent.

Table 1: Product Recommendations.

<i>Recommended DOW CORNING Product</i>	<i>Resin</i>
RM 4-7105 Resin Modifier	PP, PE, vinyl, PS, HIPS, engineering resins
RM 4-7051 Resin Modifier	PC, PPO, PBT, PET, thermoplastic elastomers
RM 4-7081 Resin Modifier	PP, PE, vinyl, PS, HIPS

Table 2: Polypropylene modified with DOW CORNING RM 4-7081 Resin Modifier and Mg(OH)₂: Heat release rate, carbon monoxide evolution, and impact strength.

<i>Material, weight %</i>	<i>Peak heat release rate, % vs. control</i>	<i>Peak CO evolution rate, % vs. control</i>	<i>Notched izod impact, ft-lb/inch</i>
Polypropylene excorpene 1012	100	100	0.821
95% PP/5% DOW CORNING RM 4-7081	55.4	39.6	0.675
75% PP/25% Mg(OH) ₂ VERSAMAG [®] UF	32.5	23.4	0.389
75% PP/20% Mg(OH) ₂ /5% DOW CORNING RM 4-7081	26.9	20.0	0.737

¹VERSAMAG is a registered trademark of Morton Thiokol, Inc.

Table 3: Cone calorimeter data for Styron[®] 438 HIPS with Dechlorane Plus^{®2} modified with DOW CORNING RM 4-7081 Resin Modifier

<i>Material</i>	<i>% Heat release rate vs. dechlorane plus control</i>	<i>% Carbon monoxide rate vs. dechlorane plus control</i>	<i>% Smoke rate vs. dechlorane plus control</i>
HIPS Control (Formulation A)	200	77.6	67
Dechlorane Plus (Formulation B)	100	100	100
DOW CORNING RM 4-7081 at 1% (Formulation C)	30.5	70	56
DOW CORNING RM 4-7081 at 2% (Formulation D)	30.1	69	55

¹STYRON is a registered trademark of The Dow Chemical Company.

²DECHLORANE Plus is a registered trademark of Oxychem.

Exhibit 6

DECLARATION OF TRANSLATOR

I, Maho KASEKI, c/o the Inoue & Associates of 3rd Floor, Akasaka Habitation Building, 3-5, Akasaka 1-chome, Minato-ku, Tokyo, Japan do solemnly and sincerely declare that I am conversant with the Japanese and English languages and that I have executed with the best of my ability this partial translation into English of a technical bulletin issued by Nippon Aerosil Co., Ltd. annexed hereto, and believe that the translation is true and correct.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements jeopardize the validity of the application or any patent issued thereon.

April 25, 2006
(Date)

Maho KASEKI
Maho KASEKI

Partial English Translation of the technical bulletin issued
by Nippon Aerosil Co., Ltd.

(1) Front Cover:

TECHNICAL BULLETIN AEROSIL®

Application of AEROSIL in the plastic industry

No. 5

Nippon Aerosil Co., Ltd.

(2) Page 2, left hand column, the first two paragraphs:

1. Grades of AEROSIL and uses thereof

AEROSIL is a highly dispersible amorphous silica obtained by the hydrolysis of silicon tetrachloride in oxygen-hydrogen flame. Specifically, AEROSIL is an aerosol of silicon dioxide particles which are linked together by agglomeration, in which the average primary particle diameter is as small as 10 μ .

AEROSIL is composed of very fine particles, and has a very large specific surface area. The grade numbers (130, 200, 300, 380 etc.) of the AEROSIL products represent the average specific surface area (m^2/g) of the AEROSIL products.

(3) Page 2, the paragraph bridging the left and right hand columns:

The silanol groups present in the surface of an AEROSIL particle bond with H₂O molecules. This means that AEROSIL is generally hydrophilic. The silanol groups present in the surface of an AEROSIL particle are reactive with organosilicon compounds (e.g., dimethyl chlorosilane). Therefore, by substituting the silanol groups with an organosilicon compound, it is possible to deprive AEROSIL of reactivity with H₂O molecule(s).

(4) Page 2, right hand column, lines 9 to 18:

..... Further, "AEROSIL R 972" is used not only as an oleophilic substance in processing of a heat-vulcanized silicone rubber, but also in a solvent type adhesive.

AEROSIL is a product of extremely high purity due to the unique production method. Another characteristic feature of AEROSIL is that the refractive index thereof is 1.46 which is close to the refractive indexes of many synthetic resins. By virtue of such a refractive index, AEROSIL can be advantageously used for obtaining a product which is transparent or almost transparent and which exhibits excellent insulation properties.

(5) Page 5, right hand column, lines 11 to 26:

2.7. AEROSIL as an active filler for a heat-vulcanized silicone rubber and various other elastomers

AEROSIL can be blended in a large amount with a heat-vulcanized silicone rubber and/or various other elastomers, so as to impart desired mechanical, electric and optical properties to the rubber and/or elastomers.

The most suitable uses of the AEROSIL products, and the most appropriate concentrations and amounts of the AEROSIL products are summarized in Table 1.

For more details on the basic information on the characteristics of AEROSIL, see, for example, the following issues of our catalogues:

"AEROSIL: basic characteristics and applications thereof" (catalogue No.4), and

"Application of AEROSIL as a liquid thickening agent" (catalogue No.7).

(3) Back cover, the top line and the far right hand corner:

NIPPON AEROSIL CO., LTD.

(A joint venture between Mitsubishi Materials Corporation and
Degussa Japan Co., Ltd.)

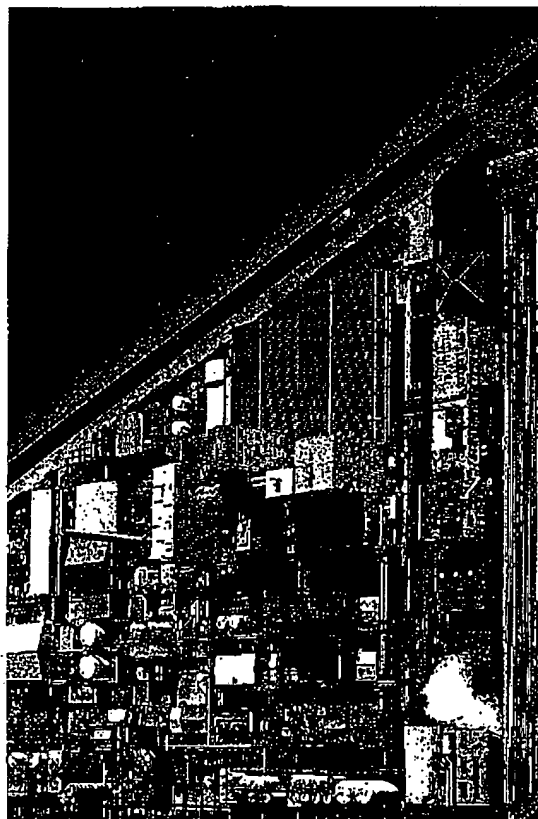
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Revised:	96. 1. 1,000

TECHNICAL BULLETIN AEROSIL®

AEROSIL の合成樹脂工業における応用

No.5

日本アエロジル株式会社



日本アエロジル株式会社 四日市工場



日本アエロジル株式会社

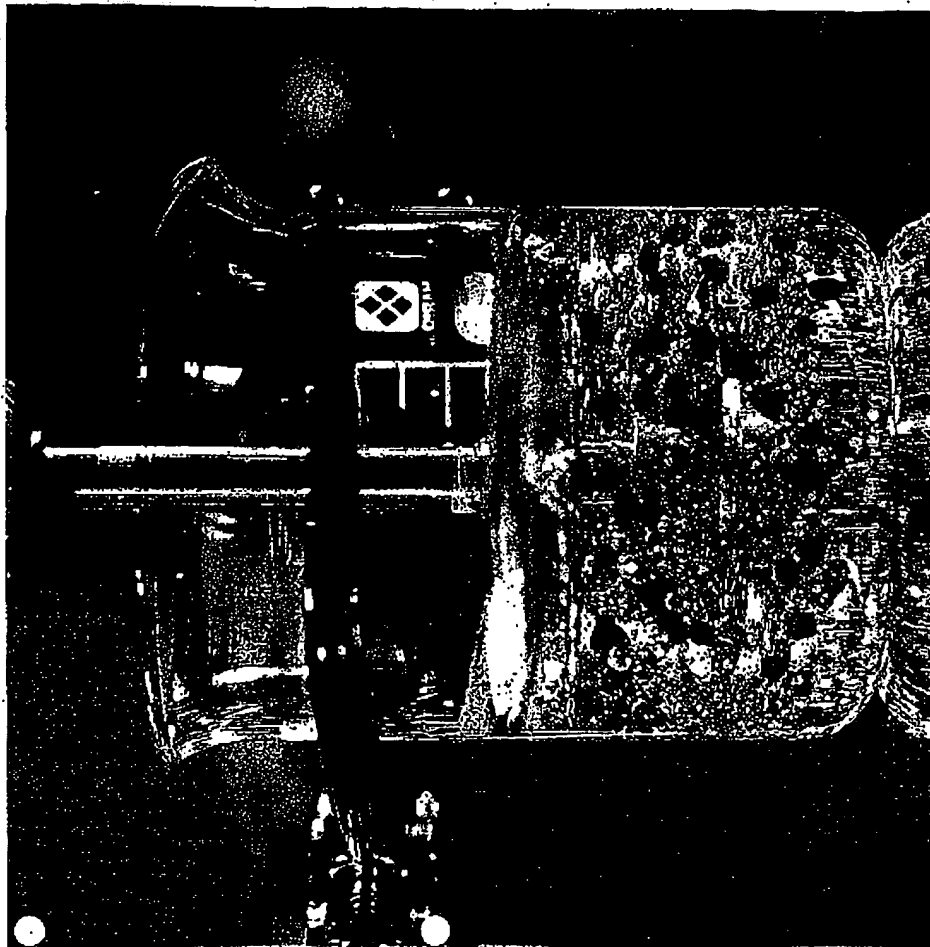
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1. 使用される

AEROSIL は、四塩化矽を酸水素塩中で加水分解して得られる高分散性の非晶質シリカで、球形の粒子が凝集してつながつた二酸化矽素のエロゾル (aerosol) である。この一次粒子は球形で、平均径はわずか10ミクロン位の大きさである。

AEROSIL の粒子は細かく、非常に比表面積の大きいものが得られ、AEROSIL のグレードを要す 130, 200, 300, 500, 380 の数字はそのグレードの平均比表面積 (m²/g) を表わしている。

AEROSIL 粒子の表面はかなり落からで、シロキサングループ($-\text{Si}-\text{O}-\text{Si}-\text{O}-$)の立体的網の目標達から成っている。その表面にある酸素原子は4個のシロキサン結合を持っているのではなく、3個であり、もう1つはOHグループを持っていて、いわゆるシラノールグループ($-\text{Si}-\text{OH}$)を形成している。

AEROSIL 粒子の表面にはシラノールグループが存在すること、またそれが表面に反応性(シラノールグループ反応)であることが、液体相を増粘する場合の増粘剤としてAEROSILが利用されるうえに、また重要な意味を持つている。このシラノールグループによって固ったAEROSIL粒子は立体的な網の目構造を形成し、これがある程度に凝集すると、ゲル構造に発展する。

・AEROSIL 粒子表面のシラノールグループは、水の分子と結合する。即ちAEROSILは

普通親水性である。このシランノールグループは有機硅系化合物（例えば ジメチルジクロロシラン）と反応性があり、有機硅系化合物との置換によって水の分子との反応性をなくすことができる。

この方法で加水化した製品が AEROSIL R 972である。この加水性シリカは、例えば粉体物質の流動性を改善するのに有効である。また、AEROSIL R 972は親油性物質として熱加硫シリコーンゴムの際に用いられるほか更に溶剤型接着剤にも採用されている。

AEROSIL[®]はその独特な製造法のために、
わめて純度の高い製品が得られる。そのほかに、
屈折率が1.46で、多くの合成樹脂の屈
折率に近いという特徴があり、したがって透
明あるいは透明に近い製品を作り、絶縁特性
のすぐれた製品をつくることが可能である。

セロファンホイルにブロッキング防止効果を与えるためには、AEROSIL分散液が用いられていて、この分散液を製造するにはAEROSIL MOX 170 が特に適している。AEROSIL MOX 170 はシリカと Al_2O_3 0.3 ~ 1.3 % の混合酸化化合物である。この製品は特に水中に分散させるのが容易で、高濃度の状態で貯蔵してもゲル状になる傾向が少ない。これと対照的なのが AEROSIL COK 84、で Al_2O_3 約 16% とシリカ約 84 % の混合物で、極性の強い液体に添加されて増粘剤ならびにチキソトロピー剤として利用される。

2. 合成樹脂工業における AEROSILの応用範囲

合成樹脂工業においてはAEROSILは添加剤として用いられるばかりでなく、充填剤としても用いられている。

2.1. 増粘剤ならびにチキソトロピー剤としてのAEROSIL.

AEROSILで得られる効果の中で最も重要なのは液体系の粘度上昇とチキソトロピー性付与である。塗料・色材工業のみならず、合成樹脂工業においても重要な特性である。

溶媒系のなかでも、とりわけポリエステル樹脂ならびにエポキシ樹脂に有効で、ガラス繊維強化プラスチック成型の場合、取扱い簡便でヤゲルコート樹脂、あるいは電気絶縁性を確保する際の成型樹脂等に用いられている。例えば、粉末焼結リゲルコート用着色ポリエステル樹脂は、AEROSIL 300 を 3% 添加すると、粘度は、3,600 cP から約 30,000 cP 以上増す。同時に「ヤケントロロ」指数が 1.1 から 5.7 に上昇する。これによって、別ページに示したヤゲルコートの塗膜厚も低下する。これに対し、かなりの塗膜厚に成型することが可能になる。

⑥. PVCプラスチックへのAEROSIL-300の添加について。

接着剤、充填剤、防食材料、印刷剤の
場合には、主としてチキソトロピー特性の調
整に用いられる。これらの物質は、例えば水

2. 合成樹脂工業におけるAEROSILの応用範囲

リククロブレン、ポリビニルアセテート、ポリビニルクロライド、エポキシ樹脂、ポリウレタン、ポリサルファイドゴム、沖崎シロココンゴム等をすべてつづつられている。物類の類についての詳細は、本文覧のあとの項目で述べる。チキソトロビ性付与の目的は、二重や三重に硬化面ならびに目地における歪れを防止することである。

接着剤の場合は、塗布するときの粘さを適度に変更できると同時に、初期接着度を改善し、接着材の耐熱安定性を向上させることができる。

液体系には更にプラスチック、セルガノ
ル、分岐体、ラチックスがある。例えば PVC
の硬質エーディング剤は AEROSIL 200 の
添加によって粘着性が得られるので、被物の
中に浸み込んでいくなくなる。(「粘着現象を
減少できる」) そのほかに厚膜型も可能となる。

また、エポキシ樹脂をベークスにした短切粉体は、流動浸漬法とならんで静電塗装の分野で大いに利用されているが、この分野でも AEROSIL によってチヤントロビの性質を付与できる。この方法では、粉体吹付け、加熱時に粘度が低下になり (PVC・常規浸漬ベークスーストで加工の場合も同様であるが) 塗膜が流れ下って行くが、AEROSIL 200 までは AEROSIL 300 の添加によって、この塗膜の流れ下りを防止できる。

・液体系に用いて、増粘剤ならびにサヤントロピー性付与剤としての AEROSIL の性質を考えると、まだまだ応用面がみつかつてくると思われる。

2.2.2. 沈降防止剤としてのAEROSIL

[illegible]

にした注型樹脂は、かなり多くの流動剤、特に石英粉を含んでいる。この場合、樹脂成分を貯蔵する間に充填剤が沈降（熱硬化性樹脂の場合には硬化する間に沈降）するのを減少させるが、万一沈降物が生じたときでも、容易に再攪拌しようということが必要である。

他の例として、ポリクロロプレネをベースとした接着剤をとってみると、その処方成分として酸化マグネシウムと酸化亜鉛を含んでいる。できあがった接着剤を貯蔵する際、これらの成分が沈降するもの、また好ましくない。貯蔵の場合とも AEROSIL 200 の添加によって沈降を防止することができる。

2.3. ブロッキング防止剤としての AEROSIL

今まで述べてきたような機能が一次粒子の性質、ならびにその良好な分散性に起因したのに対して、ホイルのブロッキング防止には、一次粒子がいくつかつながってできた二次凝集粒子が効果を発揮する。湿式法でつくられたシリカと比較して AEROSIL の凝集度は非常に高く、凝集物を管壁にほぐす（分散させる）ことが、この点が良好な増粘効果をもたらすにきわめて好都合な点である。

セロファン（セルローズ水和物）のホイルのブロッキング防止剤として AEROSIL は特に利用される。AEROSIL MOX 170 を水分散液の形にして可塑剤溶液中に添加し、二次凝集粒子を分散することなく利用できる。可塑剤溶液中から出てきたホイルは少量の AEROSIL を一様に引張り出し、乾燥後ホイルの表面上に付着して残留し、ホイルが相互に摩擦するのを防止する。

ポリエチレンならびにポリプロピレンのホイルの場合、シリカは熱可塑性樹脂中に混雑されるが、この場合、かなり高い剪断力が作

用する。これらのホイルの場合、AEROSIL のほかに、湿式法シリカも安定した二次凝集粒子が存在するので利用できる。

軟質 PVC のホイルの場合、AEROSIL は可塑剤のしみ出しを減らし、したがって「乾いたような感触」を生じ、このようにしてホイルの密着するのを防止する。特に、AEROSIL によって「plate-out」が防止される。(2.44ppm)

2.4. 粉末状物質の流動性改善のための AEROSIL

フェノール、尿素、メラミン樹脂をベースにした粉末状圧縮成型物は空気中の水分を吸収し、また室温上昇により固結する傾向がある。この場合、分散剤ならびに乾燥剤として親水性 AEROSIL 200 と親水性 AEROSIL R 972 を用いてこの固結を減少させる。(図 1 および図 2) また、少量の AEROSIL の添加でエポキシ樹脂焼結粉末の流動性を改善できる。



図 1：フェノール・尿素・メラミン樹脂焼結粉末。AEROSIL 200 1.5% 添加、7 年貯蔵後。左：無添加

PVC 粉末の場合は、AEROSIL R 972、または AEROSIL 法によって製造された Aluminum Oxide C との併用で、静電気を減少させ、その結果、粉末の流動性を改善できる。



図 2：フェノール・尿素・メラミン樹脂焼結粉末。AEROSIL R 972 0.5% 添加、7 年貯蔵後。左：無添加

原料の場合、AEROSIL R 972 で処理すると凝集度が低くなり、合成樹脂中に容易に原料を分散させることが可能となる。

2.5. 電気特性改善剤としての AEROSIL

結露電圧からできているケーブプル線の場合、可動性の電荷を吸引するための「イオンキャッチャー」としては、比表面積の高い AEROSIL 300 が利用される。これによって比抵抗を高め、静電損失を少なくできる。静電損失は、速度と関係があるので、AEROSIL 300 の添加によって、静電損失の最小値を、より高温のところにする、したがって加工適性範囲を拡大できる。

2.6. 熱可塑性樹脂の加工性ならびに表面性質改善のための AEROSIL

軟質硬質、ポリアミド、ならびに他の熱可塑性樹脂をある型や管や板等に押し出す際には、多くの場合、表面の滑らかさならびに耐

出速度の向上と均一性を改善できる。

これは、粉末状物質の流動特性を改善（押出しスクリューへの良好なる充填）し、更に一般的に押出機中における摩擦物のレオロジー的挙動の改善に役立つからである。

軟質硬質のポリエチレンならびに押出し、特にホイルの製造の場合、AEROSIL 200 は大い比表面積による吸着効果が成分の移動を抑制し、いわゆる plate-out 現象を防止する。これによって同時に表面性質を向上させる。

2.7. 熱加硬化シリコーンゴムならびに他のエラストマーの活性充填剤としての AEROSIL

AEROSIL は、熱加硬化シリコーンゴムならびに他のエラストマーに高濃度に混練され、加硫時に最適な機械的、電気的、光学的特性を与える。

どのタイプの AEROSIL が最も適しているか、製造温度ならびに添加量等に関しては第 1 表にまとめて掲げている。

なお、より詳細な基礎的データについては、弊社発行カタログ「AEROSIL の基本特性とその応用」（カタログ No. 4）

「AEROSIL の液体系統材料としての応用」（カタログ No. 7）等を参照されたい。

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